



**MISHAP RESPONSE
CHECKLIST**

**FOR
ADVANCED AEROSPACE MATERIALS/COMPOSITES**

Adapted from the USAF

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MISHAP RESPONSE CHECKLIST FOR ADVANCED AEROSPACE MATERIALS/COMPOSITES

A. Purpose: Provide critical mishap response procedures for aircraft mishaps involving advanced aerospace materials, especially composites in order to minimize the associated environmental, safety, and health hazards.

B. Scope: General, rapid-response procedures and precautions recommended for personnel involved in all phases of a fire, explosion, or high-energy impact damaged composite aircraft mishap response, including fire-fighting, investigation, recovery, clean-up, and material disposal.

C. Objective: Risk control employing realistic, although conservative, measures to maximize response effectiveness and mission accomplishment, while minimizing the hazard exposures.

D. Introduction: The variability in weather, terrain, location, damage extent, types of aircraft, and risks associated with mishaps make universal risk control procedures impractical. However, the potentially harmful vapors, gases, composite particulates, and airborne fibers generated from a composite aircraft mishap, as well the secondary exposures due to handling, clean-up, and disposal necessitate that several standard safety precautions be observed.

MISHAP RESPONSE CHECKLIST

Required Equipment:

1. Disaster Response Force (DRF) Gear
2. Radiation Monitors
3. PPE
4. Fixant/Clean-up materials

Personal Protective Equipment (PPE):

1. Coated Tyvek suit with hood and booties
2. SCBA
3. Full face respirator (Dual cartridge: HEPA and organic dust/mist)
4. Leather work gloves
5. Nitrile gloves (inner)
6. Hard-soled leather work boots (Steel toe and shank recommended)

Reference Materials:

1. AFR 355-1 Disaster Preparedness
2. AFR 127-4 Mishap Response
3. Mishap Risk Control Guidelines for Advanced Aerospace Materials
4. Mishap Response Checklist

PPE Guidelines

Burning/Smoldering Composite

1. SCBA
2. Aluminized Proximity Suits
3. Aluminized gloves
4. No rubber gloves

Broken/Splintered Composites

1. Full or half-face respirator w/ dual cartridge (HEPA & organic mist) filters.
2. Coated, hooded Tyvek suit
3. Leather work gloves (outer)
4. Nitrile gloves (inner)
5. Hard-soled work boots

Peripheral Composite Exposure

1. BDU's: Sleeves Down
2. Non-disposable HEPA filter respirator
3. Safety glasses w/ side shields
4. Leather work gloves (outer)
5. Nitrile gloves (inner)
6. Hard-soled work boots

Mishap Response Steps

1.0 The First-Responder (s) (Fire chief/Env. Science /Eng./Police) shall conduct an initial survey to inspect for:

- 1.1 Signs of fire damaged composites
- 1.2 Presence of loose/airborne fibers and particulates
- 1.3 Prevailing weather conditions/directions
- 1.4 Degree of site exposed to fire/explosion/impact
- 1.5 Local/proximal equipment/asset damage and danger.

2.0 Establish control at site.

3.0 Evacuate areas in the immediate vicinity of the mishap site affected by direct and dense fallout from the fire/explosion generated smoke plume, along with easily mobile, critical equipment. Alter/move aircraft and flight operations exposed to the immediate fallout area. Restrict all unprotected personnel from assembling downwind of the crash site.

4.0 Extinguish fire and cool composites to below 300°F. ONLY fire-fighters equipped with Self-Contained Breathing Apparatus (SCBA) are authorized in the immediate vicinity of a burning/smoking mishap site until the fire chief declares the area fire safe. If possible, care should be taken to avoid high-pressure water break-up and dispersal of composite structures.

5.0 Do NOT use helicopters or low flying aircraft to control/suppress the fire. No flight/hovering/taxiing within 500 ft AGL of the site and 1000 ft horizontally.

6.0 Rope or cordon off the mishap site and establish a single entry/exit point. Only sufficiently protected individuals are authorized in the immediate mishap site and peripheral areas. The peripheral area is designated by the environmental Science officer/engineer and/or the on-scene commander. As a guide, the peripheral area should be defined as more than 25 feet away from damaged composite parts, although it may vary depending upon environmental conditions (rain, dry, high winds, remote site, etc.).

7.0 If personnel other than those at the accident site have been directly and significantly exposed to adverse material hazards, the medical staff should be consulted for evaluation and tracking. If time permits, advise the otherwise un-threatened populace in affected or fallout areas to:

- Remain in-doors
- Shut external doors and windows
- Turn off forced air intakes
- Await further notification

8.0 Enter the crash site to conduct a more thorough survey after previously coordinating with Explosive Ordinance Disposal (EOD).

9.0 Identify specific aircraft hazards by inspection, consulting with the crew chief, weapons system manager, reference documents, contractor, or aircraft specialists. Note composite and other hazardous materials to mishap response personnel.

10.0 Advise the on-scene-commander of all findings and recommendations.

11.0 Avoid excessive disturbance of the dust by walking, working, or moving at the crash site to minimize airborne particulate fibers and dust. All contaminated footwear should be cleaned to limit the spread of debris in the area and inside support vehicles.

12.0 When exiting the crash site, personnel should use a HEPA filtered vacuum, if available, to remove advanced composite contaminants from their outer clothing, work gloves, boots, headgear, and equipment. If unavailable, efforts shall be made to wipe or brush off as much contamination as possible.

13.0 Clean sites (i.e. tent or trailer) for donning/removal of PPE should be set up as practical.

14.0 No eating, drinking, or smoking is permitted within 500 feet of the crash site, or as otherwise determined by the on-scene commander. Personnel must be advised to wash hands, forearms, and face prior to eating, drinking, or smoking.

15.0 Non-disposable clothing involved with crash/fire-damaged composite parts should be removed and laundered according to step 17.0. Personnel should shower (in cool water) prior to going off-duty to preclude injury from loose fibers. Portable showers may need to be provided for this.

16.0 When practical, remove contaminated outer garments of victims/response personnel at the scene to protect the medical staff. Advise the local medical staff of any ill effects they believe are related to their exposure to the advanced composite materials. Symptoms of ill effects include, but are not limited to:

- Respiratory tract irritation and reduced respiratory capacity
- Eye irritation
- Skin irritation, sensitization, rashes, or infections

MSDS information should be made available to qualified personnel.

17.0 Wrap and seal disposable protective clothing (coveralls) in protective plastic bags after use and discard as routine waste. Severely contaminated clothing should be discarded. Otherwise, launder nondisposable clothing separately. If laundered by a contractor, inform contractor of the presence of composite fibers and the hazard potential. The contaminated clothing should be handled with care and washed separately. The bio-environmental engineer should determine if other special handling or cleaning procedures are required.

Containment

18.0 Secure burned/mobile composite fragments and loose ash/particulate residue with fire-fighting foam or a fine water mist until a holddown fixant material can be applied to immobilize the fibers. Initial actions should concentrate on debris containment.

18.1 Fire-fighting equipment should be available during fixant/stripper application, aircraft break-up, and recovery.

19.0 Consult specific aircraft authority and the investigators before applying fixant. Safety concerns may override any delayed applications. Two types of fixants are used, one for burned composites and debris, and the other for land surfaces. Fixant is usually not needed for open terrain and improved surfaces (concrete or asphalt) unless high concentrations exist.

Caution: Fire must be completely out and the composites cooled to below 300°F

19.1 Obtain a fixant or “hold-down” solution, such as Polyacrylic acid (PAA) or acrylic floor wax and water. Light oil is not recommended because it may become an aerosol and collect on equipment, hamper material investigations, and present a health hazard. Generic acrylic floor wax, available at a wide variety of stores, should be mixed in a 10:1 water to wax ratio.

19.2 Apply (preferably spray) a heavy coating of the fixant solution to all burned composite materials and to areas containing scattered/settled composite debris. Completely coat the material until wet to ensure the particulate fiber/dust is immobilized.

Note: Strippability of fixant coatings is required where coatings are applied to debris that must later undergo microscopic analysis by crash investigators. Care must be exercised in the use of the stripping solutions since they can react with some materials and the process of stripping may damage the part. PAA may be removed by a dilute solution

of household ammonia (about 1% by volume of ammonium hydroxide in water) or trisodium phosphate (approximately one 8 ounce cup trisodium phosphate per 2 gallons of water).

20.0 If fixant is not allowed or further protection is needed, carefully wrap the coated parts and/or material with plastic sheet/film or place in a plastic bag that is minimum of 0.006 inches (6 mils) thick. Seal and secure the damaged materials with tape. Generic garbage bags are generally inadequate unless several are used as plies.

21.0 Using aircraft preservation tape, apply tape over the non-fire/crash damaged composite parts/material. These parts/materials may be required for investigative purposes. Place the damaged composite part/material in a plastic bag if possible and label as required.

22.0 If deemed necessary, soil tackifiers may be used to hold materials on sand or soil. Most solutions, including Polychem, J-Tack, or Terra Tack can be sprayed onto the ground at a rate of 0.5 gal/sq. yd.

23.0 Improved hard surfaces (i.e. concrete, asphalt, carrier deck) should be vacuumed (with electrically protected vacuums) or washed down with a detergent and water solution. The effluent should be collected via plastic or burlap coated trenches or drainage ditches. Sweeping operations should be avoided as they redisseminate the particulate debris.

24.0 Immediately flush/clean fixant-application equipment with a dilute solvent to avoid clogging.

25.0 Pad all sharp projections from damaged composite parts to prevent accidental injuries.

Clean-up and Disposal Concerns

26.0 Conduct material disposal according to local, state, federal, and international guidelines. The nearest DoD, government, or private environmental management office should be contacted for relevant disposal procedures for the advanced composite parts/material which do not require accident investigation evaluation, repair, or are not needed. Ensure the accident investigation board releases the parts before disposal is authorized.

27.0 Place hazardous waste material in sealed drums and disposed of appropriately as hazardous waste. If possible, a HEPA vacuum should be used to clean-up the local area. All crash debris, vacuum bags, coveralls, gloves, and any other contaminated materials should be properly disposed and labeled appropriately with the following: "Composite Waste. Do not incinerate. Do not sell for scrap. Composite Waste." Any required hazard warnings should also be added.

Note: Demilitarization may be required prior to material disposal if done through private contract. Coordination with the specific aircraft manager is required.

28.0 For open terrain mishap areas, the surface should be sprayed with a final foam application and plowed under after all necessary/possible material collection actions have been completed.

29.0 If aircraft were subjected to the smoke and debris of the immediately affected area, the following should be undertaken:

29.1 Vacuum the air intakes with an electrically protected vacuum cleaner.

29.2 For internally ingested smoke, visually and electronically (i.e. "sniffer") inspect all compartments for debris and vacuum thoroughly.

29.3 Prior to flying, perform electrical checks and engine run-up.

30.0 For significantly affected structures and equipment:

30.1 Thoroughly clean all antenna insulators, exposed transfer bushings, circuit breakers, etc. Inspect air intakes and outlets for signs of smoke or debris and decontaminate if necessary.

30.2 Consult more detailed electrical reference material and specific decontamination instructions for more information.

31.0 Continue to monitor affected personnel, equipment, and mishap site.

COMPOSITE MISHAP RAPID-RESPONSE CHECKLIST

- 1.0___ Conduct an initial survey
- 2.0___ Establish site control
- 3.0___ Evacuate from smoke plume/Alter flight operations/Restrict downwind assembly
- 4.0___ Extinguish fire and cool to 300°F/ ONLY fire-fighters w/SCBA until fire safe
- 5.0___ No helicopters or low-flying aircraft - 500' AGL and 1000' horizontally
- 6.0___ Cordon off mishap site w/ single entry/exit - Establish peripheral area
- 7.0___ Advise populace on actions
- 8.0___ Enter mishap site/ Coordinate with EOD
- 9.0___ Identify specific aircraft hazards and requirements
- 10.0___ Advise on-scene-commander of findings/recommendations
- 11.0___ Avoid disturbance of fibers/particulates by site-traffic/Clean footwear
- 12.0___ Remove contaminants (w/ HEPA vacuum or brushes) when exiting site
- 13.0___ Establish clean sites/areas/rooms
- 14.0___ No eating, drinking, or smoking is permitted/Wash thoroughly before eat/drink/smoke
- 15.0___ Remove clothing/Shower in cool water before going off-duty
- 16.0___ Remove contaminated clothing (if possible) from victims/personnel before medical help
- 17.0___ Advise medical personnel of ill/exposure effects and symptoms
- 18.0___ Properly dispose of clothing/Laundry clothing properly

Containment

- 19.0___ Temporarily secure particulates/fibers/ash with AFFF or water mist
- 20.0___ Consult aircraft authority/investigators - Apply fixant solution
- 21.0___ Wrap parts in plastic film or sheet and secure with tape
- 22.0___ Apply preservation tape to non-fire/crash damaged parts/material - Label
- 23.0___ Use soil tackifiers if necessary
- 24.0___ Clean improved surfaces/Collect effluent/Avoid sweeping
- 25.0___ Flush or clean fixant application equipment
- 26.0___ Pad sharp projections with foam

Clean-up and Disposal

- 27.0___ Dispose materials w/in local, state, federal, and int'l guidelines and regulations
- 28.0___ Properly dispose of hazardous waste/Demilitarize materials if necessary
- 29.0___ Properly clean open terrain mishap areas
- 30.0___ Properly clean aircraft if necessary
- 31.0___ Properly clean affected structures and equipment if necessary
- 32.0___ Monitor affected personnel, equipment, and mishap site